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(54) **A device for identifying objects**

(57) The invention relates to a device for identifying objects. It is particularly intended for the function of defining whether or not a used plastic cup inserted into a machine for collecting same is of an acceptable size. A support (2), provided with a seat (3) for housing an object (4) to be identified, is mobile on command of a drive shaft (5) and brings the object (4) from a first position into a second position along a predetermined trajectory. A fixed sensor (6) signals when an object (4) is positioned before same, and is associated to the object (4) during the object's (4) transit along said trajectory, such as to provide a first signal when the object (4) intercepts said fixed sensor (6) and another signal when the object (4) passes away from the fixed sensor (6).

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Description

The invention relates, specifically but not exclusively, to a device which can be utilized in a used plastic cup collecting machine for identifying a cup introduced into the machine, comprising, apart from the device in object: a dispenser, for distributing a deposit return coin whenever the machine identifies a cup; and a bin, into which the collected cups are directed.

Various devices for identifying objects are known, especially for identifying plastic cups, such as for example those described in patent documents FR 2580418, FR 2631477, FR 2645305, EP 0436446, and PCT/EP92/01820.

The above devices all have the characteristic of being somewhat complex, expensive and unreliable. They also are only able to identify a specific type of object or in any case have to be adjusted, often through laborious and complex operations, in order to recognise different objects, but always only one kind of object at a time.

The main aim of the device of the invention is to obviate the above-mentioned drawbacks in the prior art, by providing a device for identifying objects which is simple, extremely reliable and easily adaptable for objects of various types.

One advantage of the invention is that it is particularly suitable for identifying recipient-shaped containers, such as cups, flasks, bottles and so on, and can be adapted to identify different shapes in very little time and through simple operations.

These aims and advantages are all attained by the device of the invention, as it is characterized in the accompanying claims.

Further characteristics and advantages of the present invention will better emerge from the detailed description that follows, of an embodiment of the invention, illustrated in the form of a non-limiting example in the accompanying drawings, in which:

figure 1 is a functional block diagram of a part of the device;

figure 2 is a lateral view in vertical elevation of a part of the device, with some parts removed better to evidence others,

figure 3 is a lateral view from the left of figure 2, with some parts removed better to evidence others;

figure 4 is a plan view from above of a detail of figure 2.

With reference to the above-mentioned figures, 1 denotes a device for identifying objects, comprising a support 2 on which two sliders 8 are mounted, each bearing a seat 3. Each said seat 3 houses an object 4 which must be identified. The support 2 is mobile and driven by a drive shaft 5 to move an object 4 through a predetermined trajectory starting from an initial reference position. The drive shaft 5 is connected to the support 2 in such a way that an angular movement of the drive shaft 5 corresponds to a precise displacement of the object 4

along said trajectory. Each slider 8 is able to slide with respect to the support 2 in a normal direction to the advancement direction of the object, starting from an extreme position, where it is held by action of a spring 9.

In the described case, the object 4 is a plastic cup and the device 1 is part of a machine for collecting used plastic cups. This machine comprises a dispenser, of known type, which pays out a deposit return sum in exchange for a correctly identified cup. Further, the machine washes the cup by means of a nozzle 14 which when commanded to do so issues an upwardly-directed jet of water. Finally a bin, of known type and not included in the figures, is provided for collecting the used cups.

The seat 3 is constituted in the example by a cup-holder on which a cup rests by its upper rim lip. The holder is open on one side to allow for insertion and lateral expulsion of the cup. After washing, the mobile support 2 distances the washed cup and brings a next, dirty cup to the nozzle 14. Further provided is a fixed expeller 17 for removing the washed cup from the holder. The expeller 17 is constituted by a curved rod which is arranged crosswise to the advancement direction of the cup, with a predetermined inclination and such as not to interfere with the sliders 8. The advancing cup, drawn by the mobile support 2, impacts with its lateral wall against the expeller 17 and exits from the holder, crossing through the lateral aperture of the expeller 17. The shape and inclined arrangement of the expeller 17 permit a gradual and sure exit of the cup from the holder. In the initial reference position the cup is straight (see the top of figure 2). In figure 2, at the bottom, a cup is shown which has already completed the trajectory and is upturned such as to evacuate any substances still contained therein, as well as to be in a correct position to receive the jet of liquid coming from the nozzle 14. The nozzle 14 is not absolutely necessary to the invention, if only a gravity-induced evacuation and not a washing of the cup is desired.

The support 2 is rotatable about a horizontal rotation axis X by intermittent rotations of half a complete turn. With each rotation thereof a cup is brought from the initial reference position to the upturned position, following a semicircular trajectory. The sliders 8 are mounted on the support 2 on diametrically opposite sides with respect to the rotation axis x, and are slidable in a radial direction with respect to the support 2.

The drive shaft 5 is the shaft of a stepper motor 12 which receives command signals and translates them into a pre-defined and constant rotation angle.

A fixed sensor 6 signals the presence of a cup transiting between the initial reference position and the upturned position. Said sensor 6 comprises two reciprocally-distanced elements, between which the transiting cup passes. One of said elements is constituted by a photoelectric cell 6a while the other thereof is constituted by a light source 6b directed towards the photoelectric cell 6a. When the cup passes between the two elements of the sensor 6, the photoelectric cell 6a obviously cannot pick up the light source 6b and so sends the first signal.

When the cup has passed, the light source 6b - photoelectric cell 6a connection is restored and a second signal is emitted.

Means for detecting the angular position of the drive shaft 5 are provided, which are connected to the sensor 6 in such a way as to receive the signals sent by the sensor 6 and which detect two values relative to the positions of the drive shaft 5 on receiving the first and the second signal. The means for detecting comprise a counter 13 associated to the stepper motor 12 in such a way as to be able to count the number of command pulses received from the stepper motor 12 between the first and the second signal.

A memory 7 is connected to the counter 13 and receives the above-mentioned values, comparing the resulting difference between the values with a reference value in order to know whether to accept the cup or not. The reference value represents an identifying characteristic of the acceptable cup type.

A fixed reference guide 10 is provided for interacting with the cup transiting along the trajectory, to establish the precise and invariable position of the cup with respect to the sensor 6. The reference guide 10 comprises two parallel rods which are symmetrical with respect to the median rotation plane of the cup, and are arced and coaxial with the rotation axis x.

Two sensors 11, each associated to a cup, are fixed to the support 2, each in a predetermined position with respect to the relative cup inserted into the holder. Each of said sensors 11 signals when an object is positioned before it, and is operatively associated to a first end 4a of the respective cup.

The reference guide 10, made up of two rods, is prolonged to become a shaped guide 20 which opposes the spring 9 force and contacts with the upper end 4b of the cup transiting along said trajectory; and on contact with said upper end 4b commands a precise and invariable displacement of the cup with respect to the support 2. The shaping of the shaped guide 20 causes the cup to shift radially towards the axis of the support 2 in the following way: a first tract 20a of the guide 20 moves the cup towards the sensor 11, while a second tract 20b allows the spring 9 to push the cup away from the sensor 11.

Each sensor 11 is positioned with respect to its slider 8 in such a way that, due to the alternating motion imposed by the shaped guide 20, the first end 4a of a cup of the type acceptable by the machine nears the sensor 11 such as to intercept it; after which it distances therefrom and no longer intercepts. More precisely, the first end 4a of the cup intercepts the sensor 11 while the cup itself performs, along its semicircular trajectory, a displacement of a degree which is an indicator of the distance between the two opposite ends 4a and 4b of the cup, which is equal to the length of the cup itself.

The sensor 11 emits a first signal when the first end 4a intercepts and a second signal when said first end 4a no longer intercepts. The counter 13 is connected to the sensor 11 in such a way as to receive the signals pro-

vided by the sensor 11 and calculate, at the moment of reception of each signal, the corresponding value of the drive shaft 5 position. The memory 7 receives the two position values and compares the difference between them (which difference represents an indication of the corresponding displacement of the cup) with a reference value; thus the object (in this case a plastic cup) is accepted or rejected on the basis of this comparison.

The sensor 11 comprises a reflector photoelectric cell 11a and a reflex reflector 11b, distanced from and facing one another. When the second end 4b of the cup enters between the reflex reflector 11b and the photoelectric cell 11a, said photoelectric cell 11a emits a signal directed to the counter 13 through a wire 16. The photoelectric cell 11a is mounted on a bearing 15 to avoid winding the wire 16 up due to the rotation of the support 2. Each sensor 11 is removably fixed to the support 2 and is able to slide within a hollow seat 19 in the same sliding direction as a relative cursor 8. This is so that the sensor 11 can be correctly positioned where a cup of a different height is to be identified.

The reference guide 10 and the shaped guide 20 are shaped and arranged such as to interact with the second end 4b of the cup in order to prevent the cup from exiting from the holder due to the effect of centrifugal force during rotation of the support. To this end the shaped guide 20 is lengthened by an extension 21, which follows the cup trajectory right up to the expeller 17, and which is also formed by two arced parallel rods. This doubling of the reference guide 10, the shaped guide 20 and the extension 21 improves their action on the cup and further permits the nozzle 14 to wash the inside of the cup without difficulty when said cup is in the second position.

Other means for assessing the angular position of the drive shaft 5 might be provided, such as for example an encoder, of known type and not shown in the figures, and aimed at converting the angular positions of the drive shaft 5 into digital data which can be transmitted to the memory 7.

The sensors 6 can be of other type than the type described, such as for example direct photoelectric cells.

In alternative embodiments, the support 2 can exhibit three or more seats 3 for the cups, each being mounted on a respective slider 8 and arranged circumferentially at a regular angular distance.

The device functions as follows: a cup is inserted in the seat 3 in the start reference position, after which the drive shaft 5 is rotated about the axis x and the support 2 performs a half-turn about said axis x. During this rotation the cup cannot exit from the holder thanks to the reference guide 10, the shaped guide 20 and the extension 21. If the cup is of the type acceptable to the machine, the sensor 6 provides the counter 13 with two signals which are immediately translated into an angular displacement of the drive shaft 5. To this displacement corresponds a cup displacement equal to the height of the cup in the advancement direction to a prefixed distance from the first end 4a of the cup. For the cup to be accept-

able, this height must correspond to a value contained in the memory 7.

The signals provided by the sensors 11 are translated into an angular displacement of the drive shaft 5, which provides an indication of the height of the cup, that is, the distance between the first end 4a intercepted by the sensor 11 and the second end 4b. The correlation between the displacement of the drive shaft 5 and the distance between the second end 4b and the first end 4a of the cup is precise and invariable for each cup, being linked to the shape of the shaped guide 20.

If the device 1 cannot identify the cup, in a first embodiment of the invention the support goes backwards by half a turn to bring said cup back in to the initial reference position and the device blocks until the undesired cup is removed from the seat 3. In a second and preferred embodiment, the cup is expelled and ejected into a special container provided for rejected cups.

The reference guide 10 has as its principal function that of stabilizing invariably, each time the sensor 6 measures the cross-dimension of the cup, the distance between the first end 4b of the cup and the sensor 6 itself. Obviously the first end 4b of the cup has to be in contact with the reference guide 10 when the cup passes before the sensor, which is guaranteed by the action of the spring 9.

The reference values can be memorized in the memory 7 (that is, the height and diameter at a certain distance from the reference end) relative to two or more cups. In this way the device is programmed to accept two or more types of cup at the same time.

The reading of the sensors 6 and 11 is of the differential type, and has the advantage of eliminating some kinds of error due to intrinsic shortcomings of the sensors.

One advantage of the invention is that it includes a faculty of self-learning with regard to the reference values to be memorized in the memory 7 in the case of a change of format of the type of object to be considered acceptable.

A further advantage of the invention is that the identification of the cup happens while the cup is moved towards the washing operation.

Claims

1. A device for identifying objects, characterized in that it comprises:
 - a support (2), provided with at least one seat (3) for housing an object (4) to be identified, which support (2) is mobile by means of a drive shaft (5), and moves the object (4) according to a predetermined trajectory starting from an initial reference position;
 - a fixed sensor (6), for signalling when an object (4) is positioned before said fixed sensor (6), and which is associated to the object (4) when said object (4) is transiting along said trajectory such as to emit a first signal at a moment in which said object (4) intercepts said fixed sensor (6);

a fixed reference guide (10), which interacts with the object (4) when said object (4) is transiting along said trajectory, for establishing a precise and invariable position of the object (4) in relation to the fixed sensor (6);

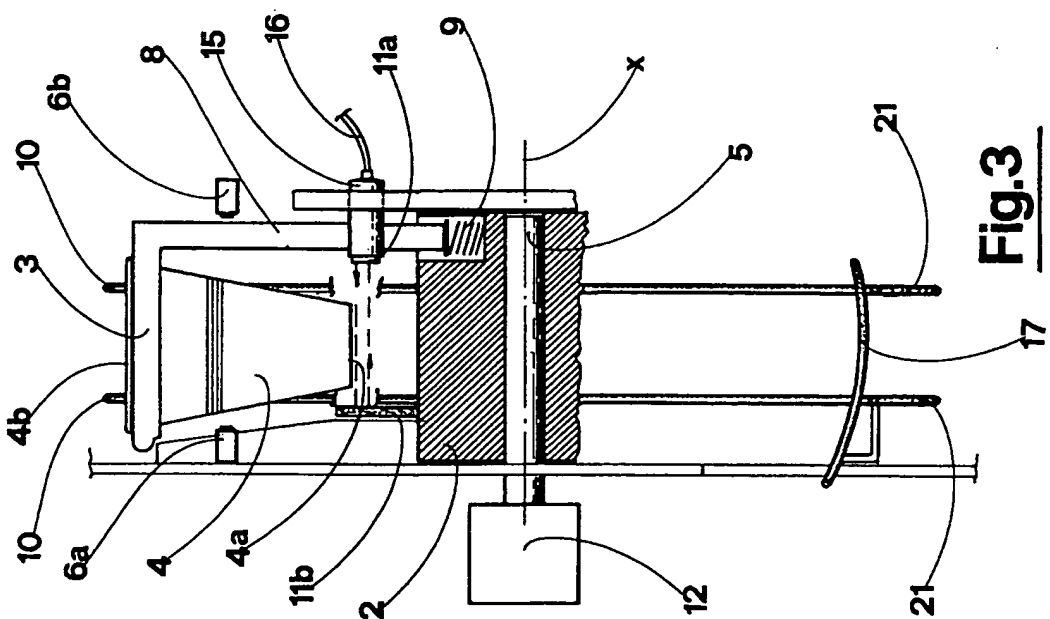
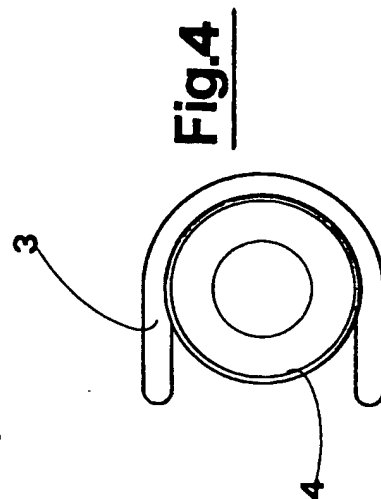
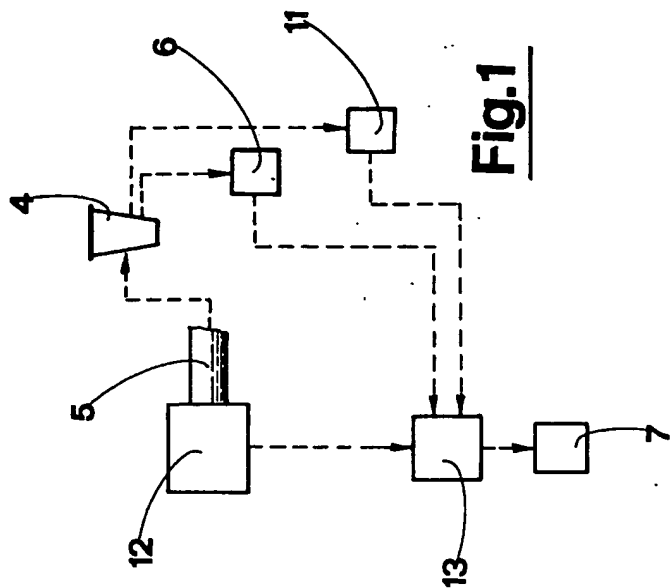
means for detecting an angular position of the drive shaft (5), connected to the fixed sensor (6) in such a way as to receive a signal emitted by said fixed sensor (6) and thereupon to detect a first value of the angular position of the drive shaft (5);

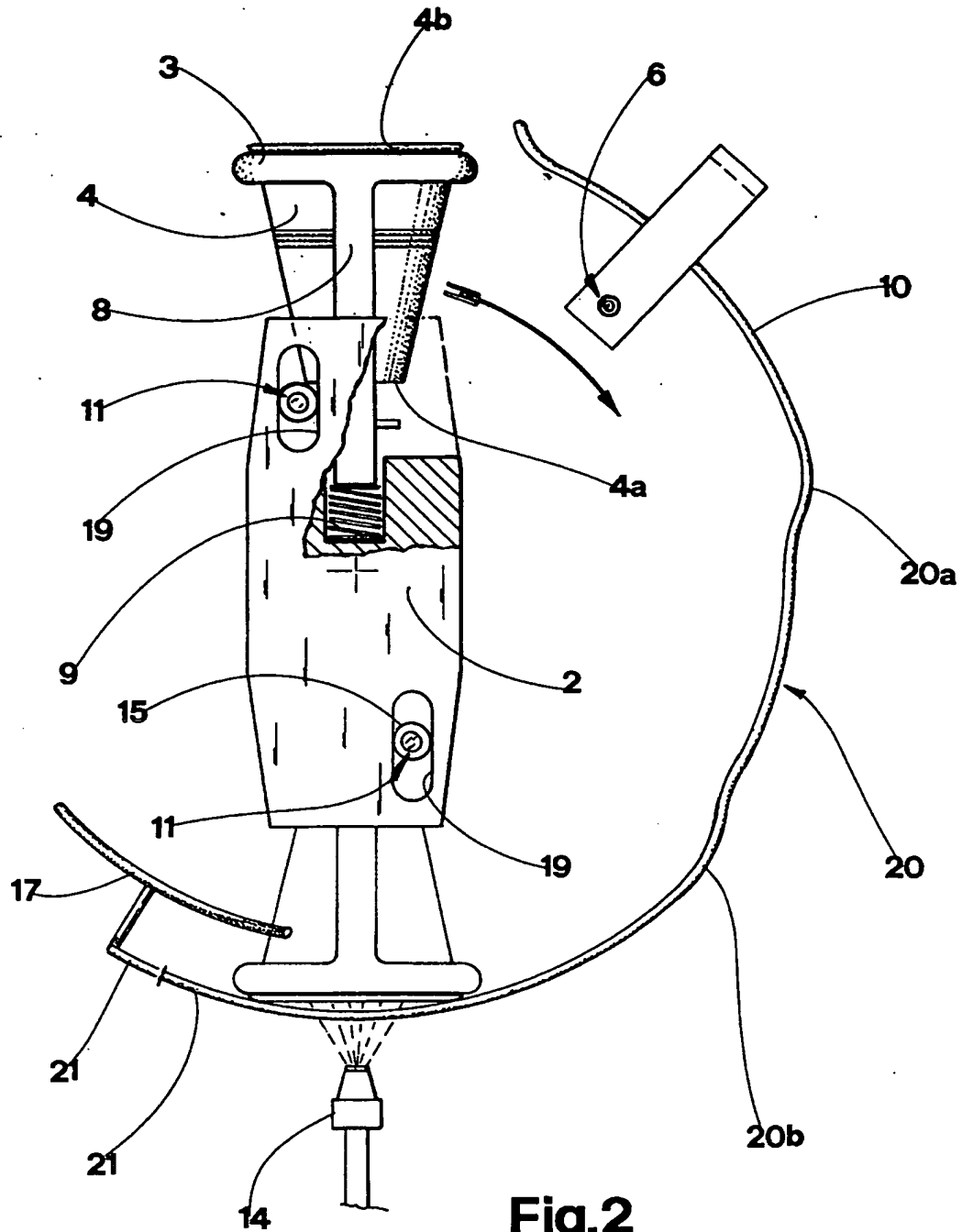
a memory (7), connected to the means for detecting an angular position of the drive shaft (5), for calculating the angular position of the drive shaft (5), which receives said first value and compares same with a reference value in order to rule on acceptability of said object (4).

2. A device as in claim 1, characterized in that the fixed sensor (6) emits a second signal when the object (4) passes out from before it, whereupon said means for detecting provides a second value of an angular position of the drive shaft (5); the memory (7) receives said second value and compares a difference between the first value and the second value with a reference value, for deciding whether or not the object (4) can be accepted.
3. A device as in claims 1 or 2, characterized in that a slider (8) is mounted on the support (2), which slider (8) bears the seat (3) and which slider (8) is able to slide with respect to said support (2) in a normal direction to an advancement direction of the slider (8), starting from an extreme position in which it is held by action of a spring (9); the fixed reference guide (10) interacting with the object (4) in transit in opposition to the action of the spring (9).
4. A device for identifying objects, characterized in that it comprises:
 - a support (2), provided with at least one seat (3) for housing at least one object (4) to be identified, which is mobile by command of a drive shaft (5), and moves the at least one object (4) according to a predetermined trajectory; the at least one object (4) being mounted on the support (2) and moveable in a normal direction to an advancement direction of the at least one object (4) starting from a position in which said at least one object (4) is held by action of a spring (9); a sensor (11) being fixed to the support (2) in a predetermined position, said sensor (11) emitting a signal when the at least one object (4) is positioned therebefore; said sensor (11) interacting with a first end (4a) of the at least one object (4), such as to emit a signal when said first end (4a) intercepts the sensor (11); a shaped guide (20), which is an extension of the reference guide (10), also being provided and being associated, when said at least one object (4) is transiting along the trajectory, and due to action of a spring (9), with a second end (4b)

of the object (4), which second end (4b) is opposite to said first end (4a); said shaped guide (20) being shaped such as to cause a precise and invariable movement of the at least one object (4) in relation to the support (2); means for detecting an angular position of the drive shaft (5), connected to the sensor (11) in such a way as to receive the signal emitted by the sensor (11) and to calculate, on receiving said signal, a value of the position of the drive shaft (5); a memory (7), connected to the means for detecting an angular position of the drive shaft (5) in such a way as to receive said reference value and accordingly to accept or refuse the at least one object (4).

5. A device as in claim 4, characterized in that the shaped guide (20) comprises a first tract (20a) which commands a displacement of the at least one object (4) towards the sensor (11) and a second tract (20b) which allows, in combination with the action of the spring (9), a displacement of the at least one object (4) away from the sensor (11), such that the first end (4a) of the at least one object (4) of a type acceptable to the device is intercepted during the displacements by the sensor (11) over a predetermined distance of the trajectory of said at least one object (4); the sensor (11) emits a second signal at a moment when the first end (4a) of the at least one object (4) no longer intercepts the sensor (11); the means for detecting calculate a second value of the angular position of the drive shaft (5) as soon as the second signal is received thereby; the memory (7) receives said second value and compares a difference between the first value and the second value with a reference value such as to define the at least one object (4) as acceptable or not.
6. A device as in claim 4 or 5, characterized in that the sensor (11) can be positioned on the support (2) facing in a direction in which the at least one object (4) can move with respect to the support (2).
7. A device as in any of the preceding claims, characterized in that: the drive shaft (5) is that of a stepper motor (12) which can receive command pulses and translate such pulses into a rotation of a defined and constant magnitude; said means for detecting the angular position of the drive shaft (5) comprising a counter (13) for counting a number of command pulses received from the stepper motor (12).
8. A device as in any of the preceding claims from 1 to 6, characterized in that the means for detecting the angular position of the drive shaft (5) comprise an encoder.
9. A device as in any of the preceding claims, characterized in that the memory (7) contains the reference values relative to at least two different objects (4).







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EUROPEAN SEARCH REPORT

Application Number
EP 94 83 0589

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	WO-A-85 05207 (DEJOUX) * abstract * * page 1, line 37 - page 2, line 9 * * page 3, line 32 - page 5, line 31 * ---	1,4	G07F7/00 G07F7/06
A	US-A-3 907 087 (TANAKA) * abstract * * column 4, line 1 - line 28 * ---	1,4	
A	EP-A-0 146 322 (ALUMINIUM COMPANY OF AMERICA) * claim 5 * ---	1,4	
A	EP-A-0 301 978 (MULLER) * abstract * -----	1,4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			G07F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		23 May 1995	Taccoen, J-F
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